The association between livestock keeping and mosquito-borne diseases in urban areas in Hanoi city, Vietnam

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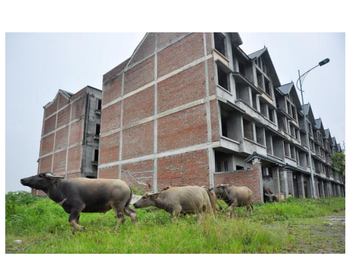
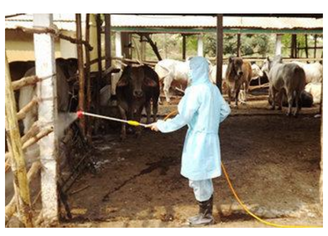
MOTIVATION

- Urban livestock keeping is an important and integral part of cities in many tropical and developing countries, where it ensures highly nutritious food on urban markets and provides inhabitants with livelihood options (Herrero *et al.*, 2013; De Zeeuw and Drechsel, 2015). However, there are also risks associated to livestock keeping that should not be neglected.
- A systematic review indicated an association between agricultural intensification and an increased risk of human disease (Jones *et al.*, 2013).
- Mosquito-related diseases, are constituting an increasing threat to human health globally, especially in tropical and developing countries (World Health Organization, 2014). Whereas livestock is increasing in the growing cities, mosquitoes also are adapting and finding urban breeding habitats.
- There has so far not been any infection with Zika virus in Hanoi, but dengue fever is emerging as an endemic disease. In 2017, Hanoi witnessed the largest dengue outbreak ever in both urban and rural districts with nearly 38,000 cases and 7 deaths. In addition, 9 cases of Japanese Encephalitis were reported (Hanoi Preventive Medicine Center, 2017).
- Since 2008, after merging areas of surrounding provinces; Hanoi city, now called "Great Hanoi", is in rapid progress of urbanization. The livestock in Hanoi was diverse and numerous with approximately 160.000 cattle, 1.6 million pigs and 23 million poultry in 2016 (GSO, 2016). Besides the advantages for high value animal-source food products; livestock keeping is potentially increasing the risk for human infections with vector-borne pathogens.
- This study attempts to increase the understanding of urban disease epidemiology in urban districts of Hanoi city where multiple vector-borne diseases are occurring simultaneously, and to an improved understanding on how urban livestock is contributing to these risks.





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PROPOSED MATERIALS AND METHODS

Component 1: Knowledge, attitudes and practices among urban inhabitants in regard to risks and benefits of urban agriculture, and the current knowledge on mosquito-borne disease transmission

- Conduct a cross-sectional study to interview randomly-selected urban households with and without livestock to explore how livestock-keeping is associated with the presence of mosquitoes. Household owners will be interviewed about their knowledge, attitudes and practices (KAP) regarding urban livestock keeping, and what economic benefits they obtain, compared to the risks and their knowledge about mosquito-borne diseases using a structured questionnaire.
- Use participatory-mixed methods to interview with stakeholders, policy makers and health personnel.

Component 2: The distribution of mosquitoes and Flaviviruses present in urban mosquitoes and its relationship to livestock keeping.

- This component focuses on the urban epidemiology of vector-borne vectors and flaviviruses, including dengue virus, Japanese encephalitis virus, and Zika virus. Within mapped sections of the cities, households will be randomly selected for screening for disease vectors.
- Both households with livestock, next-door neighbours, and households with no contact with livestock will be included. Adult mosquitoes will be collected close to human habitats as well as close to animal farms using CDC light traps, and larvae will be collected from potential breeding grounds (pots, stagnant water in trash, ponds etc).
- Livestock in the same households will be sampled for screening of antibodies. Samples of mosquitoes collected at the households, as well as samples from the livestock will be analysed using Flavivirus multiplex PCRs, Luminex-based assays and ELISAs for simultaneous detection of viral RNA and Flavivirus-specific antibodies respectively.

Component 3: Risk factors from livestock keeping of febrile patients in health centers

- Potential risk factors for urban transmission will be identified by collaborations with local health centres. Blood samples will be collected from febrile patients consenting to be part of the study and willing to answer a questionnaire about risk factors. The samples will be screened using the multiplex PCR, and their households will be investigated to identify risk factors and for sampling of potential mosquito vectors and livestock, which will be tested as in Component 2.

Component 4: An intervention for reduction of mosquito vectors in urban livestock farms

- To identify the most promising, cost-efficient and sustainable methods for controlling mosquitoes and reduce the risk for disease transmission through literature review.
- Pilot them in urban households, and assess how efficient and sustaining the methods are in an urban setting, and how they are perceived by the members of the households.
- Areas of the city will be randomly selected into controls and trial groups, and the households that participated in the screening for vectors will be followed up during the trial period. Participatory methods will be used to assess the feasibility of interventions, and the previous experiences. In the trial group, surrounding households will also be invited for training on the intervention to achieve a peer encouragement, and the households will subsequently be followed for one year, with visits after 3, 6 and 12 months, respectively, to study the following: 1) Compliance and sustainability of the method chosen, 2) Effects on vector population, and animal and human health, and 3) Perception of the household.